Dec. 4, 1962 R. WOLCHUK 3,066,771

PREFABRICATED BRIDGE DECK PANELS

Filed April 7, 1960 3 Sheets-Sheet 1

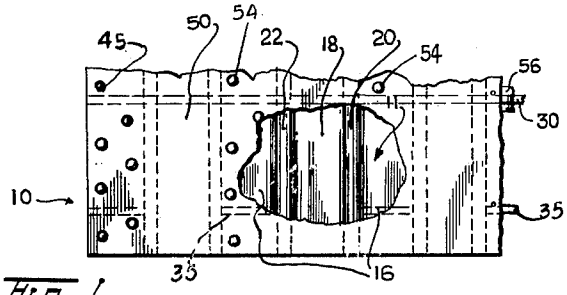

Fig. 1.

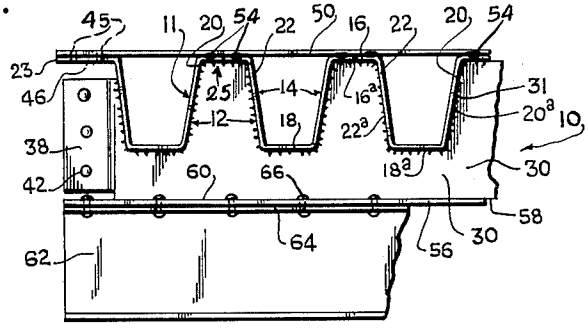

Fig. 2.

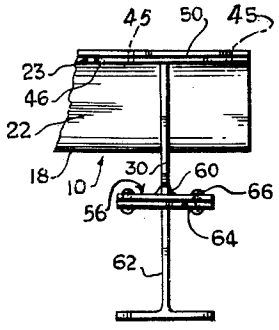

Fig. 3.

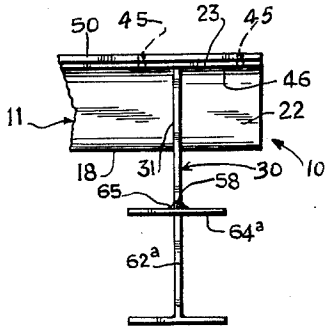

Fig. 9.

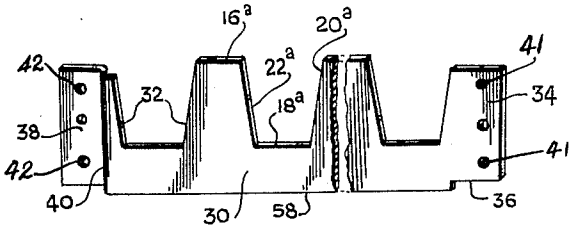

Fig. 8.

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PREFABRICATED BRIDGE DECK PANELS

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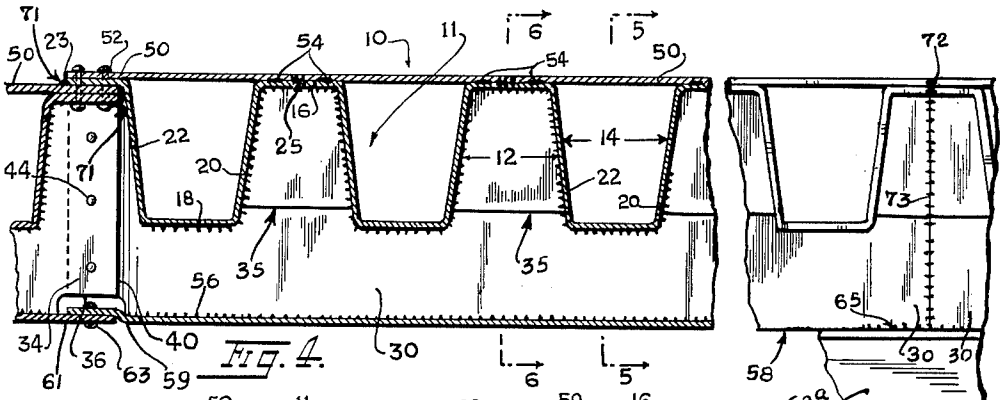

Fig. 4.

Fig. 4A.

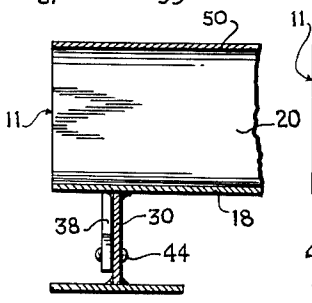

Fig. 5.

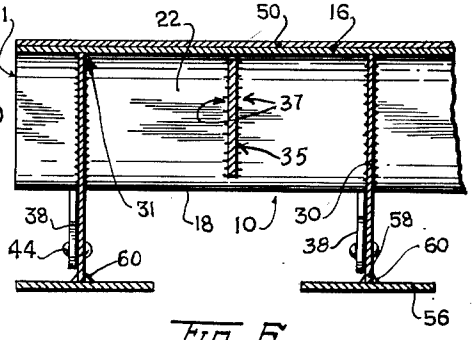

Fig. 5.

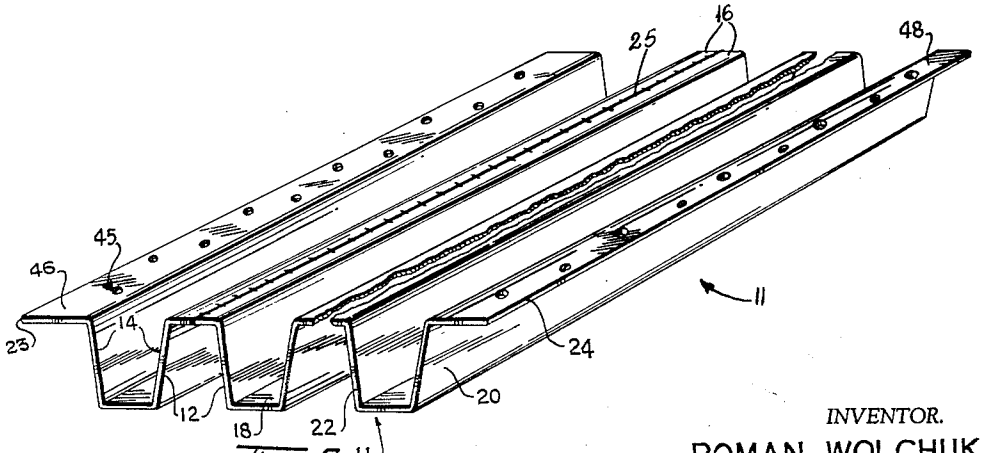

Fig. 7

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PREFABRICATED BRIDGE DECK PANELS

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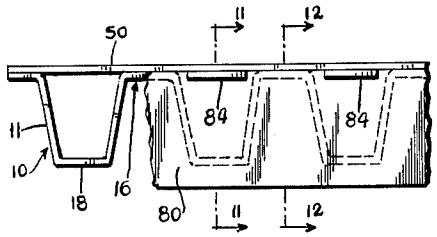

Fig. 10

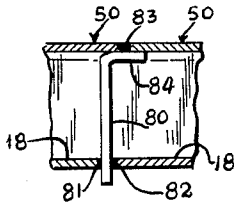

Fig. 11.

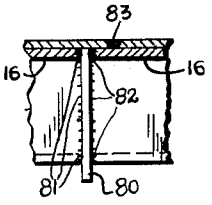

Fig. 12.

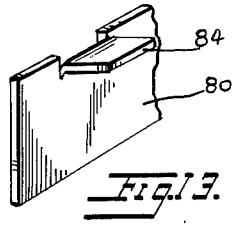

Fig. 13.

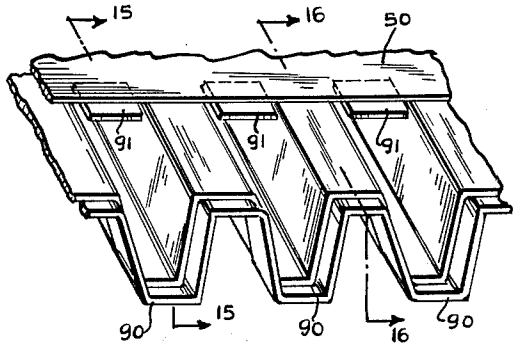

Fig. 14.

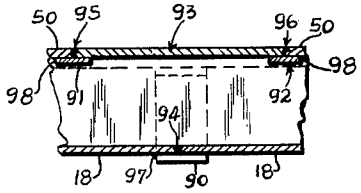

Fig. 15.

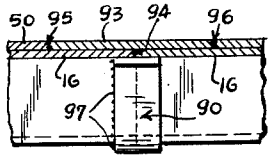

Fig. 16.

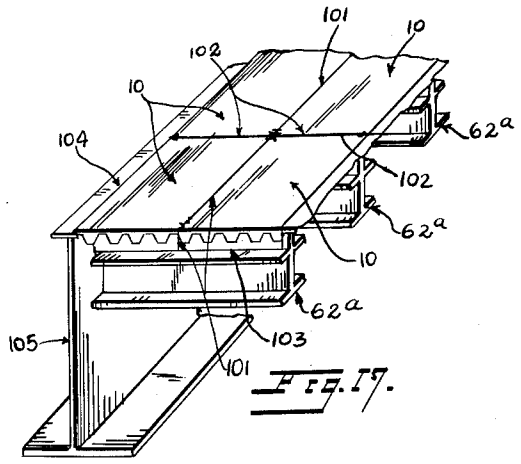

Fig. 17.

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United States Patent Office

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PREFABRICATED BRIDGE DECK PANELS

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Filed Apr. 7, 1960, Ser. No. 20,674
2 Claims. (Cl. 189—34)

This invention relates to the art of building structures and particularly concerns a novel prefabricated bridge deck panel.

According to the invention there is provided a panel structure including a fluted continuous sheet member with a flat plate connected thereto thus enhancing the stiffness of the fluted member in its longitudinal direction. The panel is stiffened in the direction perpendicular to the flutes by a series of transverse web plates having cutouts fitting the flutes. Thus, a flat panel structure is provided which is rigid in two directions and has elastic properties generally similar to those of an orthogonal-anisotropic plate.

The primary object of this invention is to provide a prefabricated bridge decking or floor structure of a light weight yet stronger and more versatile than other panels or structures used for similar purposes.

Furthermore, the prefabricated bridge deck panels described herein may be connected to the main bridge or structural members in such a manner as to form an integral part of these members. Thus, the prefabricated bridge panels, in addition to their primary function of directly supporting the traffic loads, may be simultaneously used as the upper flanges of the bridge floor beams, stringers or main girders, with resulting simplification of the construction, considerable saving of materials and a general stiffening of the entire structure.

For further comprehension of the invention, and of the objects and advantages thereof, reference will be had to the following description and accompanying drawings, and to the appended claims in which the various novel features of the invention are more particularly set forth.

In the accompanying drawings forming a material part of this disclosure:

FIG. 1 is a plan view of a portion of a panel embodying the invention, sections being broken away to show internal parts.

FIG. 2 is a vertical sectional view of the panel portion of FIG. 1.

FIG. 3 is a side elevational view of the panel portion of FIGS. 1 and 2.

FIGS. 4 and 4A are vertical sectional views on an enlarged scale of a portion of a bridge decking formed by a plurality of improved panels, showing two alternate connections along the longitudinal edges of the panels, parts being broken away.

FIGS. 5 and 6 are sectional views taken on line 5—5 and 6—6, respectively, of FIG. 4.

FIG. 7 is a perspective view of a fluted panel member employed in the invention, parts being broken away.

FIG. 8 is a perspective view of a transverse stiffener web employed in the invention, parts being broken away.

FIG. 9 is a side elevational view similar to FIG. 3 showing an alternate connection to the supporting beam.

FIG. 10 is an end elevational view of a portion of a panel.

FIGS. 11 and 12 are sectional views taken on lines 11—11 and 12—12, respectively, of FIG. 10, showing the connection of the two adjoining panels.

FIG. 13 is a perspective view of the end splice plate employed in the connection shown in FIGS. 11 and 12.

FIG. 14 is a perspective view of the end of the panel showing an alternate provision for splicing of the two adjoining panels.

FIGS. 15 and 16 are sectional views taken on lines 15 and 16, respectively, of FIG. 14.

FIG. 17 is a perspective view of a portion of a bridge illustrating application of the panels for bridge construction.

Referring to FIGS. 1 to 16, inclusive, there is shown a panel structure 10 including a sheet member 11 having a succession of flutes 12, 14 which are alternately convex and concave and a flat plate 50 constituting an integral part of the panel. The flutes are all trapezoidal in cross section with elongated flat, coplanar, parallel upper walls 16 and flat, coplanar, parallel lower walls 18. Opposite sides 20, 22 of each flute 12 flare outwardly and downwardly toward lower walls 18 of adjoining flutes 14. Sides 20 and 22 of each flute 14 flare outwardly and upwardly toward upper walls 16 of adjoining flutes 12. The member 11 is formed preferably from a single sheet of steel or other metal extruded, rolled or otherwise formed by conventional metal working machinery and may include any number of flutes. Individual widths of the member 11 are limited by the working capacity of the working machinery, or individual flutes, may be joined together as shown in FIGS. 2, 4 and 7 by means of welds 25, in order to provide any desired width of the panel 10 between the edges 23, 24.

In order to stiffen the panel 10 in the direction perpendicular to the flutes and to provide connections to the supporting beams in that direction, there are provided substantially flat webs 30, shown to best advantage in FIG. 8. Each web 30 has trapezoidal cutouts 32 which fit the lower faces of the fluted member 11. Edges 16^a, 18^a, 20^a, 22^a of the cutouts abut the member 11 and are secured thereto by welding 31. Web 30 is preferably formed from a single stiff sheet of steel or other metal. Webs 30 may be arranged as closely as necessary for the purpose of stiffening the panel 10 and providing connections to the supporting beams, as indicated in FIG. 6. One end of the web is squared off and foreshortened by a cutout 36 for a purpose to be described. The opposite end 38 of the web is bent at 40 and offset by the thickness of the web, as clearly shown in FIG. 8. This arrangement permits a succession of webs 30 to be secured one to the other to provide their continuity as shown in FIG. 4. Holes 41, 42 may be provided in the end portions 34, 38 to receive bolts or rivets 44 securing the connection.

An alternate connection of the webs 30 by means of welds 73 is shown in FIG. 4A. In this alternative the cutouts 36 and bends 40 are omitted.

For the purpose of additional stiffening of the flutes 11, additional stiffening diaphragms 35 may be provided between the webs 30, as shown in FIG. 6. These trapezoidal diaphragms 35 are fitted to the sides of the flutes 11 by means of welds 37.

The top plate 50 is secured to the top walls 16 of the member 11 by means of resistance or press welds 54 in such a manner that the plate 50 may act together with the fluted member 11 providing a succession of box-like structural members of a considerable flexural and torsional rigidity.

In order to secure the connection of the panel 10 to the supporting beams, a flat flange 56 can be secured to the lower edge 58 of the web 30 by means of the welds 60. FIGS. 2 and 3 show an I-beam 62 used as a support of the panel 10. The top flange 64 of the I-beam 62 is secured by bolts or rivets to the flange 56. In this manner the panel 10 becomes rigidly connected to the supporting beam member 62 and may act as its upper flange.

FIG. 9 shows an alternate connection of the panel 10 to the supporting beam 62^a in which the lower edge 58 of the web 30 is directly connected to the beam 62^a by the welds 65. Flange 56 is omitted. The prefabricated

panel 10 includes in this case the web 30 and does not include the beam 62a.

For connections to adjoining panels 10 along the edges 23, 24, staggered holes 45 may be provided in the end walls 46, 48 of the member 11 and in the plate 50 for the bolts or rivets 52, as shown in FIGS. 1, 2 and 4. Bolts 52 may be supplemented or replaced by welds 71 as shown in FIG. 4.

One end of each plate 56 can be offset as shown at 59 in FIG. 4 so that an end 61 of an adjacent plate 56 can be underlapped and secured thereto by bolts or rivets 63.

A bolt and hole connection may also be used to connect the panel 10 to the longitudinal beam or girder 105 along the edge 104 as shown in FIG. 17. In such a manner the panels 10 become integral parts of the girder 105 and act as an upper flange, thus greatly increasing the strength and rigidity of the girder 105.

In an alternate arrangement shown in FIG. 4A the overlap and bolted connections of the panels 10 are omitted and the panels are joined by welds 72, 73.

FIG. 10 shows an elevational view of a panel 10 with provision for connection of the two longitudinal panels. An essential part of this connection is a splice plate 80 having a cut out back-up tab or strip 84 as shown in detail in FIG. 13. The plate 80 with its back-up tab or strip 84 is connected to the flutes of the member 11 by welds 81. Welds 82 and 83 are made at the time of installation to connect the adjoining panel 10 to the preceding one, as shown in FIGS. 11 and 12.

An alternate method in connecting adjoining panels is shown in FIGS. 14, 15 and 16. A back-up tab or strip of metal 90 is secured to the flutes of one panel by means of welds 97 and back-up tabs or strips 91 and 92 are secured to the edges of the deck plate 50 by means of the welds 98. The edges of the plate 50 are cut short of the edges of the flutes 11 in order that the welds 94 joining the fluted members may be made from the top of the deck. The gap in the deck plate 50 is then closed by the splice plate 93 secured by the welds 95 and 96. In this manner a complete continuity of the fluted members 11 as well as of the deck plate 50 is achieved.

FIG. 17 illustrates the intended use of the prefabricated panels 10 for the bridge construction. Individual panels 10 are connected to each other along the lines 102 in the transverse direction and the lines 101 in the longitudinal direction of the bridge, thus providing a bridge deck continuous in both directions. Through the connections 103 to the floor beams 62a and connections 104 to the bridge girders 105 the panels 10 become integral parts of these members as their upper flanges. A thin asphaltic or similar wearing roadway surface may be placed directly on the panels 10 eliminating the need for the customary heavy bridge deck of concrete.

There has thus been provided a panel structure of a light weight yet uniquely strong in all directions, which may act as an independent load carrying deck and also may be readily combined with the transverse and the longitudinal supporting members of bridges and other structures, becoming an integral part of these members and contributing substantially to their strength. In such manner substantial economies in the use of materials, time of installation and labor cost may be achieved.

The decking panels may be prefabricated by conventional metal working machinery, using generally available welding equipment. Through the use of mass production and assembly line methods of the prefabricated bridge panels the advantages of the modern steel plate deck construction will be made generally available.

While I have illustrated and described the preferred embodiments of my invention, it is to be understood that I do not limit myself to the precise constructions herein disclosed and that various changes and modifications may be made within the scope of the invention as defined in the appended claims.

Having thus described my invention, what I claim as new, and desire to secure by United States Letters Patent is:

1. A panel structure as described including a plurality of transverse supporting beams, longitudinal supporting joists, prefabricated panels, said beams being suspended from the bottom of the panels, at least one of the prefabricated panels disposed along at least one joist, each panel including an elongated fluted sheet metal member, each fluted member having spaced openings in its long edges, a flat metal plate welded to the top of each fluted member, each top plate having openings in its long edge, transverse stiffener webs interfitting to and welded to the fluted portions of each fluted member, the perforated long edge of one fluted member and top plate overlapping the adjacent perforated long edge of the other fluted member and top plate, the openings in said overlapping portions being an alignment, bolts extending through the aligned openings, the end edges of adjoining webs overlapping, said overlapping ends having aligned openings therein and bolts extending through said aligned openings, said webs being affixed to the supporting transverse beams, said panels being affixed along their perforated edges to the upper flanges of the longitudinal joists whereby the connected panels become integral parts of the supporting transverse beams and the longitudinal joists, said panels forming a continuous surface in all directions.

2. A panel assembly of the kind described including a number of panel structures disposed end to end, each panel structure including an elongated fluted sheet metal member, a flat metal plate welded to the top of said fluted member, transverse stiffener webs interfitted to and welded to the fluted portions of said fluted member, the panel structures being connected at their ends by welding, said connection including a splice plate having cut out back-up strips extending laterally into the fluted portions of the panel structure, said splice plate being welded to the top, bottom and the sides of the end of the fluted portions, the top plate of the one said panel extending beyond the edges of the fluted member and over said backup strips and being welded to the adjoining top plate of the adjoining panel, the latter top plate of the other of said panels terminating short of the edges of the fluted member, thereby providing a complete continuity of the panel structures in the longitudinal direction.

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